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ON THE CALCULATION OF THE TRUE ANOMALY AND RADIUS VECTOR IN TERMS OF THE TIME IN AN ELLIPTIC ORBIT OF ANY ECCENTRICITY.

BY W. STEADMAN ALDIS.*

[Abstract.]

If m, u, v, be the mean, the eccentric, and the true anomalies, respectively, and r the radius-vector, of a body moving in an elliptic orbit, whose major axis is $2a$, and eccentricity e, the fundamental relations between these quantities are

$$m = u - e \sin u. \quad \dots \quad (1)$$

$$\tan \frac{v}{2} = \sqrt{\frac{1+e}{1-e}} . \tan \frac{u}{2} \quad \dots \quad (2)$$

$$r = a\,(1 - e \cos u) \quad \dots \quad (3)$$

From these three equations, any three of the four quantities r, u, v, m, are theoretically determinable in terms of the fourth. The most important case is that of finding r, v, u, when m is given. The following is offered as a complete and easy practical solution of this problem in all cases:

Writing $\sin \phi$ for e, equation (1) becomes

$$m = u - \sin \phi \,.\, \sin u,$$

or

$$\begin{aligned} 2m &= 2u - 2 \sin \phi \,.\, \sin u \\ &= 2u - \cos(\phi - u) + \cos(\phi + u) \\ &= \{\phi + u + \cos(\phi + u)\} - \{\phi - u + \cos(\phi - u)\}. \end{aligned}$$

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If the function $\overline{\cos\theta + \theta}$ be denoted by C (θ) this equation can be written

$$2m = C\,(\phi + u) - C\,(\phi - u) \quad . \quad . \quad . \quad . \quad (4)$$

If a table be formed giving the values of C (θ) for all values of θ, at small intervals, within such limits as to cover all required values of $\phi - u$ and $\phi + u$, the value of m is known when that of u is given. It is only requisite to take the two values of C (θ) corresponding to $\theta = \phi + u$ and $\theta = \phi - u$, from the table, subtract the latter from the former, and halve the difference. The determination of u when m is given is effected by finding two consecutive values of u such that, for one of them, the value of C $(\phi + u)$ − C $(\phi - u)$ falls short of, and for the other, exceeds, $2m$. The method of proportional parts will then give the sought value of u with all requisite exactness.

NOTE.—The paper of which the foregoing is a brief abstract was accompanied by a specimen of the proposed table, in which the argument is given (for every minute of arc) from 28° 0′ to 31° 0′; and in which the function is given in seconds of arc and tenths of a second, with a difference column.

PLANETARY PHENOMENA FOR SEPTEMBER AND OCTOBER, 1895.

BY PROFESSOR MALCOLM MCNEILL.

SEPTEMBER.

The autumnal equinox occurs, and the Sun crosses the equator from the north to the south, on September 22d, at about 11 P.M., Pacific time.

Eclipses. There will be two during the month.

(1.) *An Eclipse of the Moon* on the evening of September 3d. It will be total, and the entire eclipse will be visible throughout the United States. The times of the phases are as follows (P. S. T.):

		H.	M.	
Moon enters penumbra,	Sept. 3,	6	48	P.M.
Moon enters shadow,	" 3,	8	0	
Total eclipse begins,	" 3,	9	6	
Middle of the eclipse,	" 3,	9	57	
Total eclipse ends,	" 3,	10	47	
Moon leaves shadow,	" 3,	11	54	
Moon leaves penumbra,	" 4,	1	6	A.M.